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(71) Assignee: 000000376
Olympus Optical Industries Company
43-2 Hatagaya 2-chome
Shibuya-ku, Tokyo-to
(72) Inventor: Tomoyasu KAWAI
c/o Olympus Optical Industries Company
43-2 Hatagaya 2-chome
Shibuya-ku, Tokyo-to
(74) Agent: 100076233
Susumu ITO

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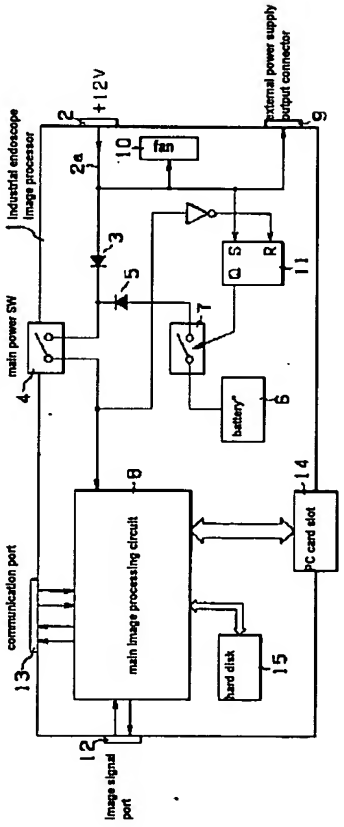
(54) [Title of the Invention] Electronic Equipment

(57) [Summary]

[Problem] The problem of the present invention is to reduce the size of electronic equipment by shrinking an auxiliary power supply that supplies electrical power at the time of backup processing of the electronic equipment.

[Means to Solve the Problem] An industrial endoscope image processor 1, which is one example of electronic equipment, comprises diode switches (diodes 3 and 5); and when power supplied to a power supply connector 2 supplying a main power supply 2a is interrupted, the power supply is switched to a battery 6 which is an auxiliary power supply. At this time, the auxiliary power supply is supplied to a main image processing circuit 8, a hard disc 15, and like devices which are necessary for a back-up process, but the auxiliary power supply is not supplied to a fan 10 and the like which is not necessary for the back-up process. Due to this composition, the capacity of the battery 6 can be reduced to reduce the size of the battery 6 so that the size of the electronic equipment can be reduced.



[Scope of the Patent Claims]

[Claim 1] An electronic equipment having a back-up means for carrying out back-up of equipment by switching to an internal auxiliary power supply when a main power supply is interrupted; wherein, at the time of the back-up processing, electrical power is supplied from the auxiliary power supply only to equipment that is necessary for execution of the back-up process.

[Detailed Description of the Invention]

[0001]

[Technical Field Relating to the Invention] The present invention relates to electronic equipment and particularly relates to electronic equipment which has a back-up means for carrying out a back-up process of the equipment by switching to an internal auxiliary power supply when a main power supply is interrupted.

[0002]

[Conventional Technology] Generally when a main power supply is interrupted during execution of processing by electronic equipment, this interruption results in loss of data undergoing processing and results in loss of state control information needed for control of the state of the equipment. Conventionally in response to this problem, for example when the main power supply is interrupted, there is a switch to an auxiliary power supply contained within the electronic equipment (e.g. comprising a battery and the like); and during the time interval when electrical power can be supplied from this auxiliary power supply, data undergoing processing is preserved and state control information is preserved during execution of back-up processing by a back-up means provided for the electronic equipment; and data and state control information losses are prevented.

[0003]

[Problem to be Solved by the Invention] However, when the main power supply is interrupted for this type of above described back-up means of the conventional technology, electric power is supplied from the auxiliary power supply to all equipment that received electrical power supply from the main power supply. Since the auxiliary power supply must maintain capacity for supplying electrical power to all of this equipment, this results in increased size of the auxiliary power supply, increased size of the electronic equipment, and increased cost.

[0004] In consideration of the above mentioned facts, the goal of the present invention is to reduce the size and the cost of electronic equipment by shrinking an auxiliary power supply that supplies electrical power at the time of backup processing of the electronic equipment.

[0005]

[Means to Solve the Problem] In order to achieve the above mentioned goal, the present invention concerns electronic equipment having a back-up means for carrying out back-up of equipment by switching to an internal auxiliary power supply when a main power supply is interrupted; wherein at the time of the back-up processing, electrical power is supplied from the auxiliary power supply only to equipment that is necessary for execution of the back-up process.

[0006] According to composition of the present invention, electrical power is supplied from the auxiliary power supply only to equipment that is necessary for execution of the back-up process, and there is a reduction of electrical power capacity of the auxiliary power supply by that electrical power capacity supplied to other devices. Thus the size of the auxiliary power supply that supplies electrical power at the time of back-up processing of the electronic equipment can be made smaller, size of the electronic equipment can be reduced, and it becomes possible to decrease cost.

[0007]

[Embodiments for Implementation of the Invention] Embodiments for implementation of the present invention are explained below while referring to figures.

[0008] (First Working Example) Figures 1 and 2 show a first working example of the present invention. Figure 1 is a block diagram showing composition of an industrial endoscope image processor which is one example of electronic equipment. Figure 2 is a block diagram showing one example of power supply from an industrial endoscope image processor to an LCD, which is an externally connected device.

[0009] (Composition) Within Figure 1, an industrial endoscope image processor 1 is shown as one example of electronic equipment. The industrial endoscope image processor 1, for example, inputs from an image signal port 12 an image signal of an observation image obtained by a non-illustrated industrial endoscope used to observe the interior of a pipe and inserted into the interior of the pipe of a piping network and the like. For example, in order to readily detect an abnormal location within the pipe, a main image processing circuit 8 carries out image processing (e.g. image intensity processing and the like). Moreover, this main image processing circuit 8 is capable of storing image data on a hard disk 15 (i.e. memory storage device), for carrying out digital filing processing to classify and adjust image processing data stored on the hard disk 15, and for carrying out image communication through a non-illustrated communication device connected to a communication port 13. Moreover, the above mentioned main image processing circuit 8 is capable of output of image data to an auxiliary memory storage device (e.g. MO and the like) which is a non-illustrated externally connected device connected through a PC card slot 14.

[0010] During normal operation, the main image processing circuit 8 supplies electrical power from a main power supply 2a through a diode 3 and a main power switch 4 (used for preventing backflow of electrical current). Electrical power of the main power supply 2a is supplied, for example, from a non-illustrated AC adapter or a non-illustrated external battery and the like through the power supply connector 2. Electrical voltage of the main power supply 2a of the present working example, for example, is +12V. When a main power switch 4 is turned ON, electrical power is supplied to the main image processing circuit 8, and electrical power is not supplied when this switch is in the OFF state. Moreover, electrical power is supplied to the hard disk 15 through a non-illustrated power supply line from the main image processing circuit 8.

[0011] Moreover, the main power supply 2a supplies electrical power to a fan 10 for air cooling of the industrial endoscope image processor 1. Moreover, the main power supply 2a is able to provide electrical power to a non-illustrated externally connected device through an external power supply output connector 9. Electrical power from the main power supply 2a is supplied to this fan 10 and the external supply connector through the diode 3.

[0012] When the industrial endoscope image processor 1 is disconnected from the above mentioned AC adapter or the above mentioned battery, or when the above mentioned AC adapter or the above mentioned battery fail, for example, due

to interruption of power supply supplied to the AC adapter, or when the power supply cable is cut, when the connection of the power supply connector 2 fails, or the like, the main power supply 2a is then interrupted, and there is a switch of power supply to an auxiliary supply as a substitute for the main power supply 2a; and a battery 6 is provided as this auxiliary power supply (e.g. dry cell battery, rechargeable battery, and the like). For the present working example, voltage of electrical power supplied from the battery 6 is +7.2V.

[0013] The main image processing circuit 8 is provided with electrical power through an auxiliary power supply switch 7, a diode 5 (in order to prevent counter-flow of electrical current from the battery 6), and a main switch 4. At this time, the cathode of the diode 5 is connected to the cathode of the diode 3. By this means, diode 3 and diode 5 comprise a so-called diode switch. Among the main power supply 2a and the auxiliary power supply supplied from the battery 6, the power supply having the higher voltage supplies voltage to the main image processing circuit 8 through the main power switch 4. When the main power supply supplies power as usual, since the electrical voltage of the main power supply 2a is higher than electrical voltage of the battery 6, the diode 3 is in the ON state, and the diode 5 is in the OFF state, and thus electrical power is supplied to the main image processing circuit 8 from the main power supply 2a. Moreover, when the main power supply 2a is interrupted, anode voltage of the diode 3 drops, and the diode 3 enters the OFF state. Accompanying this interruption, the cathode voltages of diode 3 and 5 drop, and diode 5 enters the ON state so that electrical power from the auxiliary power supply based on the battery 6 is supplied to the main image processing circuit.

[0014] An auxiliary power supply switch 7 located between the battery 6 and the diode 5 is controlled ON and OFF by an auxiliary power supply switch control circuit 11 comprising an RS flip-flop and the like comprising, for example, relay switches and the like. The auxiliary power supply control circuit 11 turns the auxiliary power supply switch 7 ON when the main power switch 4 is OFF, and when the power supply from the main power supply 2a starts, the auxiliary power supply switch 7 is turned OFF. That is to say, when electrical power supply starts from the main power supply 2a, it becomes possible to switch to the auxiliary power supply coming from the battery 6 when there is an interruption of the main power supply 2a. Even if supply of electrical power from the main power supply 2a stops after the main power switch 4 is intentionally put in the OFF state, electrical power is supplied from the battery 6 despite the interruption of electrical power.

[0015] Diode 5 comprises, for example, a light emitting diode, and thus it is possible to communicate to the operator that electrical power is being supplied from the battery 6. Moreover, rather than diode 5 comprising a light emitting diode, it is also permissible to provide another means for indication to alert that electrical current is flowing from the battery 6. The fact that electrical power is supplied from the battery 6 means that some abnormality has occurred that interrupts the main power supply 2a, and this means that there should be recognition of this condition by the operator, for example, to instruct the main image processing circuit to carry out a back-up process of the presently operating main image processing circuit 8 to cause an end of processing being carried out by the main image processing circuit 8, to preserve in-process data to the hard disk 15 and the like, and to put the main power switch in the OFF state after completion of the back-up process.

[0016] When the main power supply 2a is interrupted, flow of electrical power from the battery 6 to the fan 10 and to the external power supply output connector 9 is prevented by the diode 3. That is to say, during interruption of electrical power, electrical power is supplied only from the battery 6 to those devices necessary for execution of the back-up process (e.g. the main image processing circuit 8, the hard disk 15, and the like), and electrical power is not supplied to devices not necessary for the back-up process (e.g. the fan 10 and the external power supply output connector 9).

[0017] Therefore it is permissible for the battery 6 to have a capacity for supplying a quantity of electrical power over the "time interval until completion of the back-up process" at the "electrical power of the devices needed for carrying out back-up processing"; and it is permissible for there not to be the capacity for supplying electrical power to all of the devices. That is to say, it is possible to decrease capacity of the battery 6 by that quantity, it is possible to decrease size of the battery 6, it is possible to decrease size of the industrial endoscope image processor 1, and it is possible to lower cost.

[0018] However, Figure 2 shows an example of supply of electrical power to an LCD 23 (liquid crystal display device), which is one example of an externally connected device, through an external power supply cable 22 from the external power supply output connector 9 of the industrial endoscope image processor 1 shown in Figure 1, which is one example of the electrical equipment.

[0019] Along the external power supply output cable 22 are provided a voltage conversion circuit 21 for converting electrical voltage output from the external power supply output connector 9 to the power supply voltage of the externally connected device and a voltage monitoring circuit 24 for observation of variation of output voltage from the external power supply output connector 9. When the voltage monitoring circuit 24 senses variation of electrical voltage, notification of this variation is given to the voltage conversion circuit 21 so that the voltage conversion circuit maintains output electrical voltage constant. Previously, the voltage stabilization circuit (comprising the voltage conversion circuit 21, the voltage monitoring circuit 24, and the like) has been provided within the electrical equipment (i.e. the industrial endoscope image processor 1 and the like), and thus it becomes possible to reduce the size of the electrical equipment (i.e. the industrial endoscope image processor 1 and the like) due to disposal among the external power supply output cable 22.

[0020] (Results) Due to construction of the present working example as explained previously, when the main power supply 2a is interrupted, electrical power from the battery 6 (i.e. auxiliary power supply) is supplied only to devices needed for the back-up process (i.e. the main image processing circuit 8, the hard disk 15, and the like), and electrical power is not supplied to devices that are not needed for the back-up process (i.e. the fan 10, the external power supply output connector 9, and the like). It is possible to decrease capacity of the battery 6 by this quantity, the battery 6 can be made smaller, the electrical device (e.g. the industrial endoscope image processor 1) can be made smaller, and it is possible to decrease cost.

[0021] (Working Example 2) Figures 3 and 4 show a second working example of the present invention. Figure 3 is a block

diagram showing composition of an industrial endoscope image processor that is one example of an electrical equipment. Figure 4 is a flow chart for explanation of a control procedure for back-up processing. Furthermore, composition of parts not explained for this working example are the same as the composition of those explained for the first working example.

[0022] (Composition) As shown in Figure 3, for the present working example, an industrial endoscope image processor 41, as one example of electronic equipment, in contrast to the first working example, is provided with a voltage monitoring circuit 31 for monitoring voltage of the main power supply 2a. The voltage monitoring circuit 31 is constructed so as to output a signal to the main image processing circuit for notification when voltage of the main power supply 2a drops, for example, below +10V and below +9V.

[0023] Since the main image processing circuit 8 is able to sense lowering of electrical voltage of the main power supply 2a, it becomes possible to initiate the start of back-up automatically without initiation of backup manually by manual operation such as that of the first working example.

[0024] Figure 4 shows the control procedure during the back-up process. Furthermore, items S1 through S8 within Figure 4 indicate processing steps. The control procedure of this working example shown in Figure 4 is executed by the main image processing circuit 8.

[0025] Firstly, when the main power switch 4 is turned ON while the main power supply 2a is supplied from the power supply connector 2, the main image processing circuit 8 operates, and the control procedure starts from the processing step S1. Thereafter, as indicated by the processing steps S2 and S3, the main image processing circuit 8 observes voltage of the main power supply 2a via the signal from the voltage monitoring circuit 31. During the processing step S2, when voltage of the main power supply 2a is sensed to have dropped below 9V, the main image processing circuit 8 initiates the back-up process indicated by processing steps S5 through S8. During the back-up process, firstly as indicated by processing step S5, data undergoing processing is preserved. Next as indicated by processing step S6, there is a shutdown of software (programs undergoing execution and the like), and then during the processing step S7, processing is carried out for the shutdown of hardware (e.g. starting of a non-illustrated automatic power supply cutoff circuit for setting the main power switch 4 automatically in the OFF state and the like). This step is completed when the main power switch 4 becomes OFF, and the control procedure is completed as indicated by the processing step 8.

[0026] However, during the processing step S3, when it is sensed that electrical voltage of the main power supply 2a drops below 10V, the main image processing circuit 8 notifies the operator (via an alarm message by a non-illustrated buzzer or a non-illustrated LED or a non-illustrated screen) of the fact that voltage of the main power supply 2a has dropped, and then electrical voltage of the main power supply 2a is observed during the processing steps S2 and S3.

[0027] (Results) In addition to the results described for the first working example, the following results can be obtained according to the present working example as explained above. Due to the voltage monitoring circuit 31 connected to the main image processing circuit 8 as shown in Figure 3, it becomes possible for the main image processing circuit 8 to sense a drop of electrical voltage of the main power supply 2a, and thus it becomes possible for the main image processing circuit 8 to automatically initiate the back-up procedure according to the control procedure indicated in Figure 4. Moreover, as shown in Figure 4, due to display of a warning message indicating the drop of electric voltage of the main power supply 2a below a moderate state (e.g. below or equal to 10V), it is possible for the operator, as may be required, to quickly carry out the back-up procedure and the like.

[0028] Furthermore, the present invention is not limited to just the above mentioned working examples, and various types of changes are possible within a scope that does not depart from the gist of the invention. For example, the main power supply voltage and the auxiliary power supply voltage are not limited to the respective +12V and +7.2V combination, and these can have any voltages. Furthermore, when a diode switch (comprising the diodes 3 and 5) is used as per the above mentioned working examples, the electrical voltage of the main power supply is set beforehand to be higher than electrical voltage of the auxiliary power supply. Moreover, at this time, the devices receiving the electrical power supply from the auxiliary power supply are configured beforehand to be those devices that can be operated at least by both the electrical voltage of the auxiliary power supply and the electrical voltage of the main power supply. Moreover, for example, when the main power supply 2a is interrupted, the devices not supplied electrical power from the auxiliary power supply are not limited to the fan 10 and the external connected devices connected to the external power supply output connector 9, and such devices may be any device not related to the back-up process of the electronic equipment (e.g. floppy disk drive, CD-ROM drive, and the like). Moreover, for example, the electronic equipment is not limited to the industrial endoscope image processor 1 and 41, and this electronic equipment may be any other electronic equipment equipped with the same type of back-up means. For example, this equipment may be an image processor connected to a medical endoscope, or this equipment may be a personal computer, a communication device, and the like.

[0029] (Appended items)

(Appended item 1) Electronic equipment having a back-up means for carrying out back-up of equipment by switching to an internal auxiliary power supply when a main power supply is interrupted; wherein at the time of the back-up processing, electrical power is supplied from the auxiliary power supply only to equipment that is necessary for execution of the back-up process.

[0030] (Appended item 2) The electronic equipment according to appended item 1, wherein the main power supply is supplied from a commercial power supply or from an external power supply device.

[0031] (Appended item 3) The electronic equipment according to appended item 1, wherein the auxiliary power supply is a battery such as a dry cell battery, a rechargeable battery, and the like.

[0032] (Appended item 4) The electronic equipment according to appended item 1, wherein the back-up process includes processing to preserve on a memory storage device state of the electronic equipment at the time of electrical power stoppage of the main power supply.

[0033] (Appended item 5) The electronic equipment according to appended item 1, wherein the back-up process includes processing to preserve data that the electronic device is processing at the time of electrical power stoppage of the main power supply.

[0034] (Appended item 6) The electronic equipment according to appended item 1, wherein the devices that receive power supply from the main power supply and do not receive power supply from the auxiliary power supply include a fan for cooling the electronic equipment.

[0035] (Appended item 7) The electronic equipment according to appended item 1, wherein the devices that receive power supply from the main power supply and do not receive power supply from the auxiliary power supply include an externally connected device provided with electrical power through the electrical equipment.

[0036] (Appended item 8) The electronic equipment according to appended item 1, wherein the electronic equipment further comprises a voltage monitoring circuit for monitoring electrical voltage of the main power supply and for display of a warning message indicating lowering of electrical voltage of the main power supply.

[0037] (Appended item 9) The electronic equipment according to appended item 1, wherein the electronic equipment further comprises a voltage monitoring circuit for monitoring electrical voltage of the main power supply and for automatic initiation of the back-up process when the main power supply electrical voltage drops or is interrupted.

[0038] (Appended item 10) Electronic equipment having a means for supplying DC electrical power to an externally connected device connected at the exterior; wherein the equipment comprises a circuit, disposed in a connection cable supplying the electrical power to the externally connected device, for stabilization of electrical voltage input to the externally connected device.

[0039]

[Results of the Invention] According to the present invention as explained previously, electrical power is supplied from the auxiliary power supply only to devices necessary for execution of the back-up process so that capacity of the auxiliary power supply is reduced by the quantity of electrical power supply provided to other devices. Thus it becomes possible to reduce the size of the auxiliary power supply supplying electrical power at the time of the back-up process of the electronic equipment, it becomes possible to reduce the size of the electronic equipment, and it becomes possible to lower cost.

[Simple Description of Figures]

[Figure 1] Figure 1 and Figure 2 show the first working example of the present invention, and Figure 1 is a block diagram showing composition of an industrial endoscope image processor that is one example of an electronic device.

[Figure 2] This is a block diagram showing one example of composition when electrical power is supplied to an LCD, which is an externally connected device, from the industrial endoscope image processor.

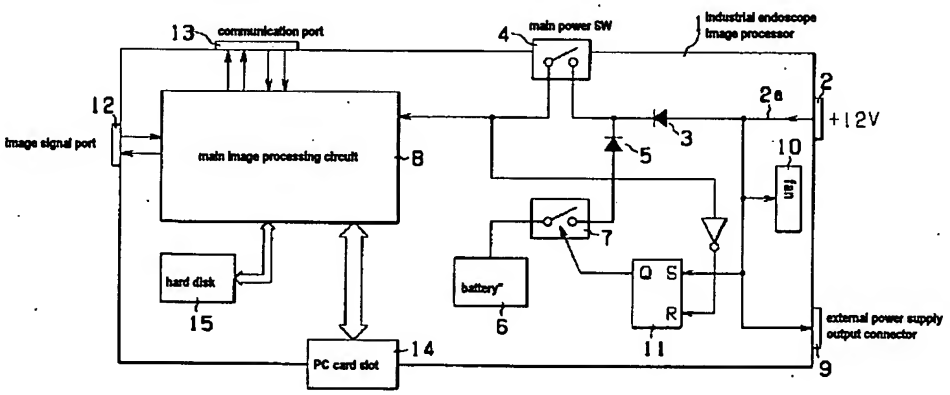
[Figure 3] Figure 3 and Figure 4 show the second working example of the present invention, and Figure 3 is a block diagram showing composition of an industrial endoscope image processor that is one example of an electronic device.

[Figure 4] This is a flow chart for explanation of the control procedure of the back-up process.

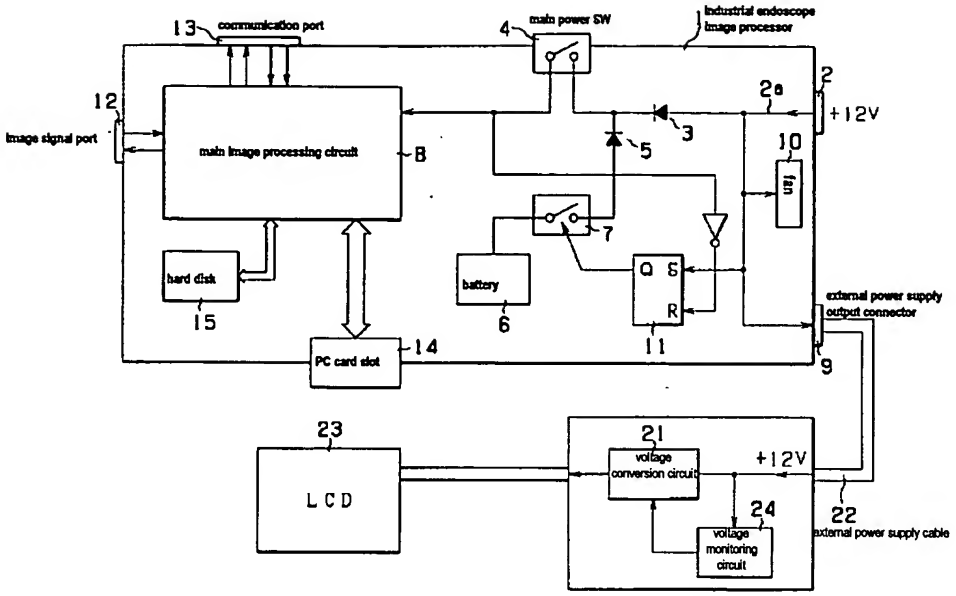
[Description of Item Numbering]

1 ... industrial endoscope image processor
2a ... main power supply
3 ... diode
5 ... diode
6 ... battery (auxiliary power supply)
8 ... main image processing circuit
9... external power supply output connector
10 ... fan
11 ... auxiliary power supply switch control circuit
15 ... hard disk

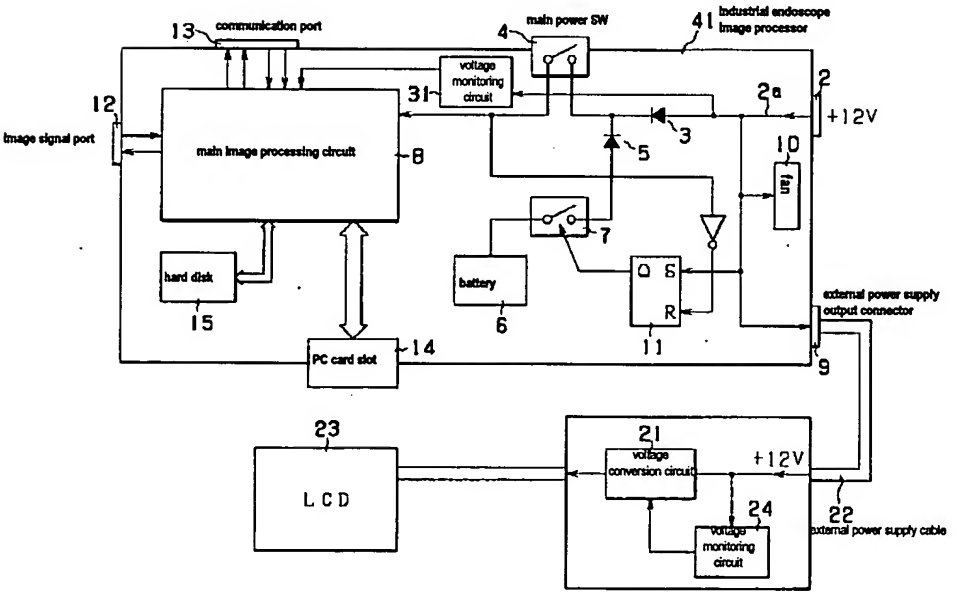
[Figure 1]



[Figure 2]



[Figure 3]



[Figure 4]